

Visible



Thermal Infrared



## Forest Fire Observation

Timely information about conditions on the perimeter of a forest fire is difficult to obtain; inaccessibility of the terrain hampers ground observation and aerial views of the fire are obscured by smoke. Ames Research Center has demonstrated how these difficulties can be surmounted by use of airborne remote sensing techniques such as those regularly employed by the

Center in earth resources survey operations.

In a 1980-81 series of flights, an Ames U-2 high-altitude survey aircraft served as an aerial fire observation system capable of "seeing" through the smoke. Equipped with two types of sensors, the U-2 produced real-time infrared images of fireground scenes, providing significant advantages over conventional fire monitoring practices.

The U-2's service in a fire at Kings Canyon National Park, California exemplifies the utility of airborne remote sensing. At Kings Canyon, thick smoke blocked visibility from the air and treacherous terrain made deployment of firefighters dangerous in the absence of a known fire perimeter. The information acquired by the U-2's scanners defined the fire boundary and aided fire management decisions by showing the size, shape and direction of burn and the location of hot spots in the fire zone. The comparison views (left) illustrate the advantages of remote sensing: in the upper view, taken by a conventional aerial camera, the fireground is totally obscured by smoke; in the infrared image, the fire boundary is clearly defined.

The diagram (below) describes the Ames fire observation process. Flying over a fireground at about 65,000 feet, the U-2 sends sensor data in digital form to an antenna at Ames Research Center. There the data is computer-processed into images, which are overlaid on U.S. Geological Survey topographical maps of the fire area. The maps are then transmitted by telecopy machine directly to the fire control center. The whole process, from U-2 to fire camp, takes less than 10 minutes and the U-2 has sufficient endurance to provide fire propagation information for five hours.

The Ames antenna can pick up signals from the U-2 anywhere within a 300-mile radius from Ames, thus allowing coverage of virtually all forest land in California. Coverage could be increased by adding other ground stations, and transmission via satellite would allow real-time fire observation anywhere in the world.

